RESEARCH UPDATE Vol.5 No.2
December 2009
ISSN : 1675-5820

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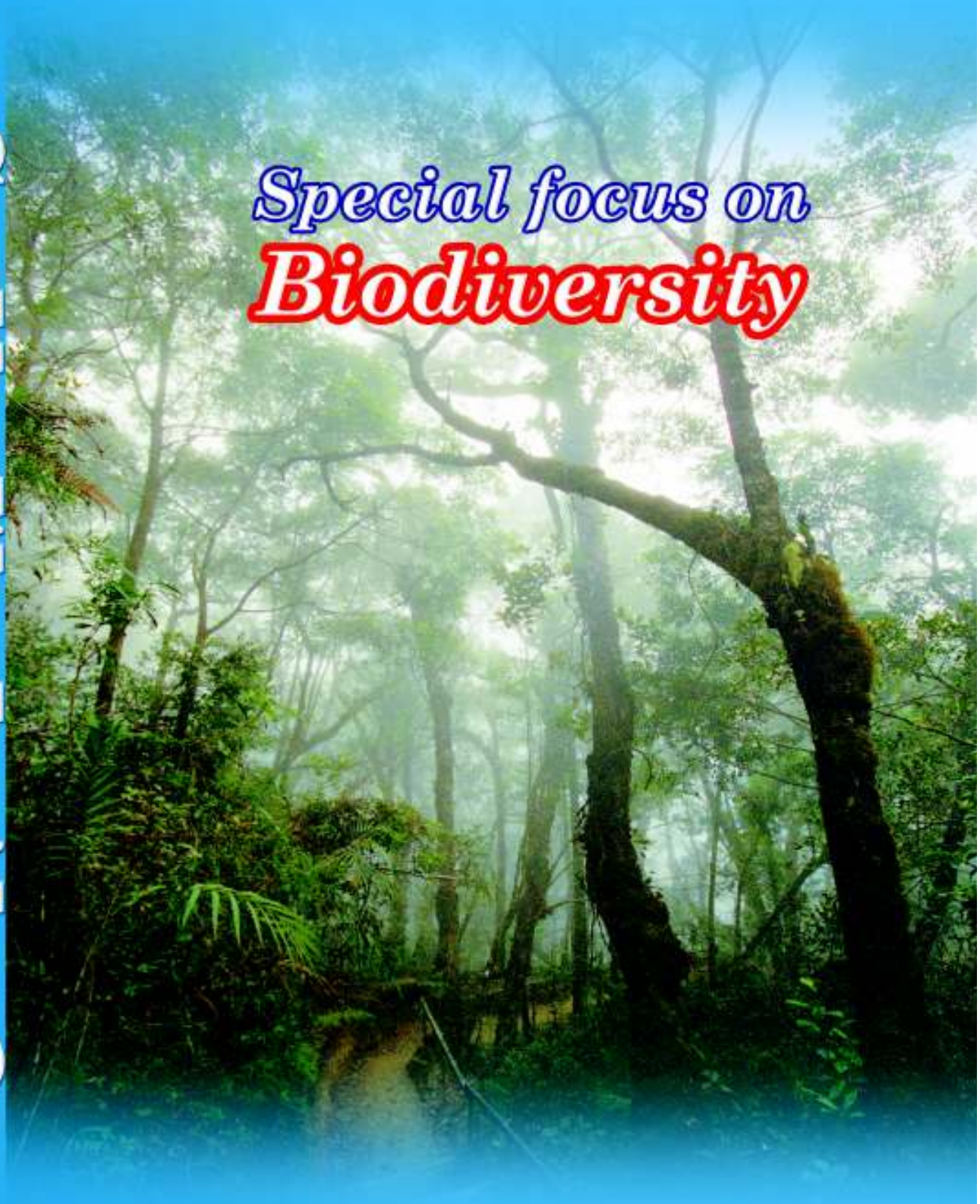


Special focus on Biodiversity

FOREWORD

From its inception, UNIMAS has put much emphasis on the biodiversity of the natural environment in Sarawak. The study on biodiversity is very much part of our focus in our research frontier. The reason is while Sarawak is a state well known for its immense wealth in biodiversity, our knowledge of our own "backyard" is relatively scarce.

It would be a great lost should we choose to ignore what we have. All our activities, the food we eat, the water we use, the air we breathe, come directly or indirectly from the vast network that exist within our natural environment. Even with all our technological advances and know-how, the supplements and medicines that have helped keep the human population live a longer and better life are sourced, copied or modified from what natures have created.

UNIMAS firmly believe that our knowledge of the natural flora and fauna that dwells in our rivers, wetlands, mountains and forests will assist in our ability to create a more sustainable world. While we owe a great deal to some of the earlier researchers such as the renowned British naturalist, explorer, geographer, anthropologist and biologist, Alfred Russel Wallace (1823–1913); it is time that we, as responsible inhabitants of this region, take the effort to understand and preserve the vast biodiversity in Borneo and its surrounding regions.

The quality of our lives depends on properly functioning ecosystems to maintain an environment conducive for a healthy living. Also, while the government is striving for sustainable development and industrial practices, we need to decipher how the ecosystems function and how species function in them in order to help realise this. The updates presented in this issue are compiled to inform our stakeholders of the various researches concerning biodiversity in UNIMAS, and I hope we would be able to gather more supports, especially in terms of financial funding, for this area of research which stands at the heart of our natural environment.

Prof Dr Peter Songan
Deputy Vice Chancellor (Research & Innovation)

CONTENTS

ECTOPARASITE FAUNA OF FOREST RATS IN SARAWAK

Ectoparasites are organisms that live on the surface of another living organism to obtain nourishments. They are among the most diverse and widely ditributed organisms in the world, and affect just about every form of life, including humans, animals and plants. The aim of this study is to investigate the taxonomic composition of ectoparasites of forest rats in Sarawak while determining their zoonotic potential. Ectoparasites of forest rats were collected from three sites in Sarawak: Lanjak Entimau, Nanga Merit and Bukit Aub. Nine ectoparasite species were recovered from eight individual of rats in Lanjak Entimau (six mites, one listrophorid, two chiggers), nine species from 15 rats in Nanga Merit (one tick, seven mites, one listrophorid) and six species from five rats in Bukit Aub (two ticks, two mesostigmata mites, one listrophorid, one lice). Mesostigmata mite *Laelaps* sp. (Figure 1) possesses the highest infestation followed by listrophorids and tick *Ixodes* sp. (Figure 2). Among the ectoparasites recovered, the tick *Ixodes granulates* which was mostly found in the rat species *Sundamys muelleri* is of importance to public health as it is known to transmit Langat virus. This study is still on-going and further analyses will be done to indentify the host-specific and zoonotic potential ectoparasites.

Figure 1: *Laelaps* sp. (Mesostigmata mites)

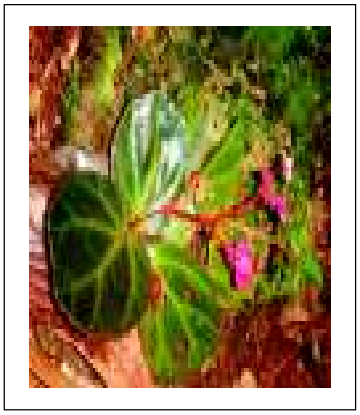
Figure 2: *Ixodes* sp. (Tick)

Researcher:
Madinah Adrus, Fatimah Abang and Mohd Tajuddin Abdullah

TWO NEW BEGONIAS SPECIES (*BEGONIACEAE*) FROM SARAWAK, BORNEO

Two new begonias from Sarawak are described and illustrated. *Begonia hidirii* Tawan, Ipor & Meekiong is a new begonia species collected and recorded from Mount Murud areas. This hairy cane-like begonia belongs to section *Petermannia* and was recorded at an altitude of more than 1600–1700 m above sea level which occupied the damp and wet places of mixed dipterocarp forest. *Begonia kurakura* Tawan, Ipor & Meekiong, collected and recorded from Lanjak Entimau Wildlife Sanctuary, is a dwarf begonia from the virgin hill mixed dipterocarp forest at 130–140 m altitude. This beautiful species also belongs to section *Petermannia*.

Begonia Hidirii: a new species from Gunung Murud



Begonia kurakura: a new species from Lanjak Entimau

Researchers:
C.S. Tawan, I.B. Ipor, Hidir, M., A. Ampeng*, Marzuki, B.* & Meekiong, K.

* Sarawak Forest Department

FLORAL BIOLOGY INVESTIGATION OF JATROPHA CURCAS L. (JARAK PAGAR): A NEWLY ESTABLISHED BIOFUEL CROP

Jatropha curcas L. (of the family Euphorbiaceae) is a small tree of up to 5 m in full grown height. Originally from Central America, it has been grown in Malaysia as an ornamental plant and for fencing in the home gardens. It is a monoecious plant and the flowers are unisexual, however hermaphrodite flowers do occasionally occur. This particular species has been identified as the next potential biofuel crop in Malaysia and effort has been initiated by the government and privates sectors to grow *J. curcas* as a large scale plantation crops. But other than fuels, J. curcas is traditionally known for other multiple uses, and based on these the extracts from other parts of the plant can be exploited for industrial pharmaceutical purposes, and the residue from the seed extraction which is high in protein can potentially be used for animal and fish feed, as well as as organic fertilizer. However, the current basic information on *Jatropha*'s growth performance, floral characteristics and fruit production especially in Sarawak are scarce. To tap this information, a preliminary study on the morphology and floral development of *J. curcas* at Kampung Rembus, Kota Samarahan was conducted. Five cultivated plants of about 8 years old were selected for morphology and floral biology study. The following findings were recorded: J. curcas produced 0–9 pistillate flowers and 12–97 staminate flowers per inflorescence. About 2-9 pistillate flowers developed into mature fruits per inflorescence, and none when pistillate flowers were absent. It took two months for the fruits to develop to maturity and ripen. The ripened fruits dehisced passively and seeds fall off together with the capsule. Each fruit consists of an average 3 seeds and each seeds weighed 0.5 g to 1.29 g with and average of 1.12 g. Overall, it took about 8-10 weeks for a complete cycle of flowering to ripening of the fruit. Thus, fruit productivity is estimated at 3-4 cycles annually. Bees, thrips and ants (*Camponotus* sp. and *Paratopula* sp.) are potential pollinators while caterpillar of the family Noctuidae the potential notorious pest. However, for an in depth investigation, more sampling data from different localities is needed for a more comprehensive information.

Researchers:
Tawan, C.S, Norshima, F.P., Meekiong, K., Petrus, B. & Ipor, I.B.

MEDICINAL PLANTS OF THE MALAY COMMUNITY IN KOTA SAMARAHAN DISTRICT, SARAWAK

An ethnobotanical survey on medicinal plants was carried out in three selected coastal villages of the Malay community at Kota Samarahan, District. The survey was conducted at Kampong Pinang (E110° 26' 31.3", N 01° 26' 31.3"), Kampong Empila E 110° 30' 22.7", N 01° 25' 49.6" and Kampong Melayu (E 110° 31' 25.2", N 01° 24' 27.5") in August 2006-March 2007. Information was obtained by interviewing the elderly who has the knowledge of the medicinal plants species, uses and preparations. The collected specimens were preserved and kept at Universiti Malaysia Sarawak Herbarium (HUMS). Species were identified and described accordingly, and their individual uses and preparation for treating diseases were also included. The survey identified 54 species (from 31 families of plants) with medicinal value; they cover various treatment for common illnesses or diseases such as antidotes for snake bites, asthma, diarrhea, fever, flu, headache, hypertension, rheumatism, stomach ache, skin diseases, toothache and ulcer. The documentation of these medicinal plants is vital as this traditional knowledge is fast disappearing, and very often, improperly disseminated or not disseminated to younger generation due to the lack of interest and awareness.

Researchers:
Tawan C.S, Alwin, G.J., Ipor, I.B. & Meekiong, K.

PLANT DIVERSITY IN TRADITIONAL FRUIT GARDEN (DUSUN) OF DIFFERENT COMMUNITIES IN SARAWAK

The study on the diversity of tree and herbaceous plants grown in traditional dusun by different communities in Sarawak was conducted at Kampung Landeh, Kuching (representing Malay community), Kampung Grogo at Bau (representing Bidayuh community) and Kampung Remun at Gedong, Samarahan (representing Iban community). Plots of 20m x 20m were established to obtain the floristic composition and estimated above ground biomass in the selected traditional dusuns. The most dominant tree species was *Durio zibethinus* for Kampung Landeh, *Baccaurea bracteata* for Kampung Grogo, Bau and *Lansium domesticum* for Kampung Remun, Gedong. The result revealed that the degree of stratification and tree size varied between dusun from different ethnic groups. The biomass of all surveyed fields ranged between 98.2 t/ha to 287.7 t/ha. The total estimated above ground biomass from Kampong Grogo, Bau was comparatively higher than those from Kampong Remun, Gedong and Kampong Landeh. Mature Koompasssia excelsa trees contributed mainly to the high value of biomass at this particular location.

Researchers:
I.B. Ipor, C.S. Tawan, A.N. Liew & M. A. Chagat

FLORISTIC COMPOSITION AND CONSERVATION OF VIRGIN HIGHLAND MIXED DIPTEROCARP FOREST AT BATU LAWI, BARIO, SARAWAK,

Batu Lawi is part of the proposed Pulong Tau National Park that includes Gunung Murud complex. It is the highland complex and is located in the interior part of Sarawak. Visitors to this part normally take at least 3 days jungle trekking from Bario. Batu Lawi commands one of the most spectacular natural formations of hundreds of meters of sharp jagged limestone structures, fascinating natural landscapes, diverse wilderness, and highly diverse flora and fauna. The richness of its diverse resources, as well as strategic location, should justify for it to be protected as a conservation area such as Mulu National Park. The floristic structure and the composition of tree species in its forest vary according to the elevation each land area. More tree species with high total estimated above ground biomass and leaf area index were recorded at lower elevation. (1400 – 1700m a.s.l.). The lower zone is dominated by *Agathis alba, Eugenia baramensis, Payena maingayi, Dehaasia incrassata, Cryptocarya cagayanengis, Lithocarpus sundaicus, Tristania alata* and *Xanthophyllum pulchrum*; while the upper zone is dominated by *Tristania anomala, Adinandra delmosa, Eugenia arcuatinervis, Eugenia regangense, Knema ashtonii, Actinodaphne pruinosa, Antidesma peurocarpum, Quercus kinabaluensis, Lithocarpus sundaicus and Diospyros evena. Agathis alba,* with huge basal stem and more than 40m attainable height, is considered as an emergent species and contributed to almost 50% of the total estimated above ground biomass at 1600 – 1700m a.s.l. With the luxuriant population and substantial preponderance of several important species such as *Agathis alba* and *Tristania spp.*, strictly no logging is recommended within the entire complex and promotion activities intensified to highlight its importance as an ecotourism spot.

Researchers:
I.B. Ipor, C.S. Tawan & J.Ismail

FLORA COMPOSITION OF THE RIPARIAN VEGETATION LANJAK ENTIMAU WILDLIFE SANCTUARY

Lanjak Entimau wildlife sanctuary covers a total area of 168 km. It has two water shed, the Rajang tributaries which includes Sungai Katibas, Sungai Ngemah and Sungai Kanowit on the northern part and the Batang Lupar, Batang Ai, Sungai Engkari and Batang Skrang on the southern part. Lanjak Entimau wildlife sanctuary is known to contain one of the richest flora diversity in Borneo. It harbours eight distinct forest types and established secondary forest of 30 to 100 years old which offers ecological knowledge of tropical species succession and forest. Hence, in an effort to explore the flora diversity of Lanjak Entimau, a general collection and survey of the flora were conducted at selected riverine localities at Begua (N 01° 39' 21.2", E 112° 15' 58.8') and Sungai Sarkawi (N 01° 39' 24.1", E 112° 14' 44.7') during the Lanjak-Entimau Scientific Expedition in June 2008. A total of 220 trees were recorded from the six plots of 20 x 25 m at two localities in Begua and Sungai Sarkawi, and the total biomass estimation was 128,248 kg. Among the common tree species identified were of the Dipterocarpaceae, namely, *Dipterocarpus oblongifolius* Bl. *Shorea macrophylla* (de Vr.) Ashton and *Parashorea macrophylla* W.Sm.ex Ashton. These trees were huge, 35 – 70 cm dbh (diameter at breast height). Other tree species identified were *Alangium havilandii* Bloemb. (Alangiaceae), *Bhesa paniculata* Arn. (Celastraceae), *Baccaurea racemosa* (Reinw.) Muell.-Arg. (Euphorbiaceae), *Dacryodes rostrata* (Bl.) H.J. Lam (Burseraceae), *Dimorcarpus longan* Lour. (Sapindaceae), *Gymnacranthera contracta* Warb. (Myristicaceae), *Kompassia excelsa* (Becc.) Taubert, (Fabaceae), *Lithorcarpus ruminatus* Soepadmo (Fagaceae), *Mitrephora glabra* Scheff. (Annonaceae) *Myristica lowiana* King (Myristicaceae), *Nephelium cuspidatum* Bl. (Sapindaceae), *Ochanostacys amentacea* Mast. (Olacaceae), *Quassia borneensis* Nooteboom (Simaroubaceae) *Tabernaemontana macrocarpa* Jack (Apocynaceae) *Saraca declinata* (Jack) Miq. (Fabaceae), *Santiria laevigata* Bl. (Burseraceae) *Swintonia glauca* Engl. (Anarcardiaceae), *Pentaspadon motleyi* Hook f. (Anacardiaceae) *Palaquium stenophyllum* H.J. Lam. (Sapotaceae), *Pometia pinnata* Forst. (Sapindaceae) and *Potoxylon melagangai* Kosterm. Lauraceae). Common genera recorded for the forest floor were the *Begonia, Boesenbergia, Costus, Clidermia, Mapania, Piper, Plagiostachys, Pinanga,* and *Tetracera.*

Costus ballehensis: new species form Kapit

Researchers:
Tawan, C.S., Ipor, I.B., Jusoh, I., Meekiong, K., Malcom, D., Sekudan, T., Hidir, M. & Mohd Rizan, A.

GINGERS OF LANJAK ENTIMAU WILDLIFE SANCTUARY

Zingiberaceae species are a diverse group of rhizomatous, aromatic perennial herbs with the centre of diversity in South-East Asia. The *Zingiberaceae* diversity in Lanjak Entimau Wildlife Sanctuary, Sarawak, documented in this paper includes surveys conducted in March-April and May-June 2008. Most species were flowering during the period between March-April and many were fruiting or in vegetative state in the latter period; hence the number of taxa identified for May-June may be an underestimate. More than seventy species belonging to 15 genera, 4 tribes and 2 sub-families were collected and recorded from 14 sites or stations including areas around Sg. Chemanong, Sg. Katibas and Sg. Latong from Kg. Hulu. The data implicates that this area is rich in gingers, accounting for 75% of the total genera and more than 40% representing the species recorded for Sarawak. Five species were identified to be new species. The tribe *Alpinieae* represented by 8 genera and 44 species predominates followed by the tribe *Zingibereae* (5 genera, 22 species). The tribes Riedelieae and Globbeae are each represented by *Burbidgea* (3 species) and *Globba* (8 species) respectively. Aproximately 40% of the gingers encountered here inhabited the riverine vegetation, followed by dipterocarp forest and with at least 6 species found as lithophytes. *Amomum, Burbidgea, Hedychium* and the new species of *Alpinia* were epiphytes. *Alpinia niewenhuizii, Burbidgea pauciflora, Burbidgea stenantha, Etlingera brevilabrum, Etlingera kenyalang, Geostachys rubra, Globba atrosanguinea, Hornstedtia havilandii, Hornstedtia tomentosa, Plagiostachys strobilifera and Zingiber pachysiphon* are considered as common. Many of the species discovered in Lanjak Entimau may prove to be potential resources for ornamentals, medicinal oils and medicinal herbs with various therapeutic properties.

Researchers:
H. Ibrahim*, Meekiong, K., I.B. Ipor, C.S. Tawan, Hidir, M. Norhati M. R.*, Lam N. F.**, C.K. Lim***, Ampeng, A.****

*University of Malaya
**Universiti Malaysia Sabah
*** Folia Malaysiana Sdn. Bhd., Penang
****Sarawak Forest Department

CRYPTOCORYNE AURICULATA ENGLER IN LANJAK ENTIMAU WILIDLIFE SANCTUARY

Cryptocoryne, the trumpet plants are morphologically different from most other species of the same genus. Even though these plants possess high endemism, *Cryptocoryne* have high morphological plasticity and varies according to their environment. *Cryptocoryne* covers diverse habitats such as the inner tidal zone (the amphibious life forms), the slow to fast running rivers (aquatic life forms) and at the bank of some of the smaller plant covered rivers and stream (rheophytic life forms). *C. auriculata* Engler which is easily recognized by its stiff and silvery leaves, and short spathe with forward twisted and dark red to black purple limb is endemic to Sarawak and only recorded in 5 localities in Sarawak, namely Gamalat, Tajuk and Kaki Wong in Julau, and Mador and Empran in Meradong District. It grows on sandy to sandy alluvial soil and stony ground with moderately fast rivers or streams. Most of its recorded occurrence at the riverbanks showed that the plants survive well on complete exposure to heavy shaded condition. In addition, recorded occurrence of *C. auriculata* at Sungai Datai, Sungai Belawak and Sungai Latong of Lanjak Entimau Wildlife Sanctuary has extended its population in Sarawak.

Researchers:
I.B. Ipor, Meekiong, K. and C.S. Tawan

AN ENUMERATION OF ONE HECTARE OF PEAT SWAMP FOREST AT BUKIT LIMA NATURE RESERVE, SIBU, SARAWAK

One hectare of peat swamp forest at Bukit Lima Nature Reserve (BLNR) was enumerated for all trees with a diameter breast height (DBH) of ≥ 5 cm. A total of 1211 trees belonging to 122 species, 76 genera and 49 families were recorded. Fagaceae was the most abundant family (44.1%) followed by Dipterocarpaceae (20.0%). *Lithocarpus* (21.8%), *Dryobalanops* (10.7%), *Chepalomappa* (9.9%) and *Shorea* (7.3%) were the most abundant genera. In term of importance value (I_v), *Lithocarpus dasystachyus* (Miq.) Rehd. with I_v = 23.9 is the most dominant species, followed by *Dryobalanops rappa* Becc. with I_v = 15.6. The regeneration capability of the genera as assessed in term of the number of seedlings are dominated by *Lithocarpus, Xanthophyllum, Litsea* and *Xerospermum*. The common underground herbaceous plants are ferns species (*Asplenium longgisimum, Nephrolepis biserrata* and *Stenochlaena palustris)* and *Piper spp.*

Researcher:
Meekiong, K., I.B. Ipor, C.S. Tawan, Hidir, M. & Sekudan, T.

EDIBLE WILD MUSHROOMS IN MALAYSIA

The use of wild mushrooms as food source is common among villagers in Malaysia, especially those far from town and therefore, depends on forest products for their food supply. At least forty five species of wild macro-fungi is consumed by various ethnics in this country. These edible mushrooms include species of *Agaricus, Amanita, Auricularia, Boletus, Calostoma, Collybia, Cookeina, Coprinus, Dyctiophora, Favolus, Hygrocybe, Lentinus, Lyophyllum, Panus, Pleurotus, Polyporus, Russula, Schizophyllum, Stereum, Termitomyces, Tramella, Volvariella* and *Xylaria.* Of these, *Auricularia spp.* and *Schizophyllum commune* are the more popular ones, and are consumed many throughout the country. Various species of *Termitomyces* (macro-fungi that grows on termite's nest), found in this country in this country are edible. The occurrence of *Termitomyces* species, however, is more common and abundant in Peninsular Malaysia and Sabah, but not in Sarawak. During its season, a large amount of fruiting body of this particular mushroom can be seen on soil arising from termite nests, in areas such as oil palm plantations as well as at the backyards. They are often collected and sold in the markets. When in season, *Calostoma, Hygrocybe, Lentinus* and *Volvariella* species can be found in the market of various places in Sarawak

Picture: *Calostoma insignis*

Researcher:
Sepiah M.

MACRO-FUNGI OF LANJAK ENTIMAU WILDLIFE SANCTUARY

A total of 308 species belonging to 101 genera and 45 families of macro-fungi have been identified in Lanjak Entimau Wildlife Sanctuary. Most of these fungi grow in soils and in dead standing trees, decaying woods, branches and leaves; only five species were collected from stem or leaves of living plants. A higher number of species were collected belonging to the genera *Amanita, Boletus, Hygrocybe, Marasmius, Pleurotus, Russula, Amauroderma, Ganoderma, Innonotus, Microporus, Phellinus* and *Trametes.* The most common and abundant fruiting bodies of macro-fungi identified in this forest were of *Microporus affinis* and *M. xanthopus*. Edible macro-fungi identified in the area include *Amanita crocea, Auricularia auricular, A. polytricha, Calostoma sp, Cookeina sulcipes, C. tricholoma, Hygroporus connica, H. punicus, Lentinus connatus, Pleurotus saju-caju, P. djamor, Pleurotus ostreatus, Shyzophylum commune, Termitomyces sp.* and *Tremella fusiformis. Earliella scabrosa, Lignosus rhinoceros* and *Pycnoporus coccineus*, known as having medicinal values or are used as insect repellant by the locals were also collected.

Picture: *Microporus affinis*

Researcher:
M. Sepiah and A. Afni

MACRO-FUNGI OF LOAGAN BUNUT NATIONAL PARK

A total of 131 fungal taxa belonging to 4 classes, 10 orders and 25 families were collected in Loagan Bunut National Park. Almost all of the macro-fungi collected in the forest were from plant materials, and were above the ground level. *Maramius* and *Mycena* of the family Tricholomaceae were the common genera of the agaric fungi collected in the area, while *Ganoderma* spp., *Microporus* spp., *Phellinus* spp. and *Trametes* spp. were the common poroid mushrooms.

Trametes sp

Phellinus spp

Researcher:
Sepiah, M., Noreha Mahidi, Norhayati Ahmed Sajali, Mohamad Rezuan Sarbini and Jaya Seelan, S.

MACRO-FUNGI OF GUNUNG MURUD, SARAWAK

Collections of samples were made at 15 sites of various altitudes at Gunung Murud, Sarawak. A total 517 samples of macro-fungi, classified based on their morphological characteristics, were recorded. Only 138 samples were obtained at altitude higher than 1800 m a.s.l; more diverse fungi taxa were found at the lower altitude of the mountain range. The common macro-fungi at the higher altitude of the mountain were of family Marasmiaceae, especially *Mycena* and *Marasmiellus* species. Other interesting macro-fungi found in the highland forest included *Anthracophyllum*, *Calostoma*, *Pseudohydnum* and *Lotia* species. Poroid fungi, such as *Ganoderma* and *Polyporus* species were also found. At the lower altitude, the occurrence of macro-fungi was not only rich in species number but the number of fruiting bodies of many taxa formed on the substrates in the same sampling site or different sites were also abundant. *Amanita, Collybia, Hygrocybe, Laccaria, Lentinus, Mycena, Marasmiellus, Marasmius, Pleurotus, Russula* and *Tricholoma* were amongst the agarics found in the area. *Auricularia, Boletus, Clavaria, Cookeina, Cyathus, Ganoderma, Haxagonia, Microporus, Phellinus, Polyporus, Pycnoporus, Stereum, Thelephora* and *Trametes* were amongst the non-agaric fungi. The known edible species of *Calostoma* was found in the lower altitude of the mountain range. All of the collected samples were dried and deposited in the university and identification work is still ongoing.

Mycena sp.

Cookeina

Calostoma sarasinii

Researcher:
Sepiah, M. and S. Norhayati

TRAMETES SPECIES FROM KUBAH NATIONAL PARK AND MATANG WILDLIFE CENTER OF SARAWAK

Four species of *Trametes* have been collected from Kubah National Park and Matang Wildlife Center, in Sarawak. Two species of the *Trametes* were found in Kubah National Park and have been identified as *T. ljubarski* and *T. orientalis*, while the other two species were collected in Matang Wildlife Center, which have been known as *T. velutina* and *T. cervina*. All of these species were identified based on the macro- and micro-morphology characteristics of their fruiting bodies and their cultures characteristics on Malt Extract Agar (MEA). The species identifications have also been confirmed by direct sequencing of amplified ITS region of ribosomal DNA of the fungi.

Researcher:
Afni, A and Sepiah,M.

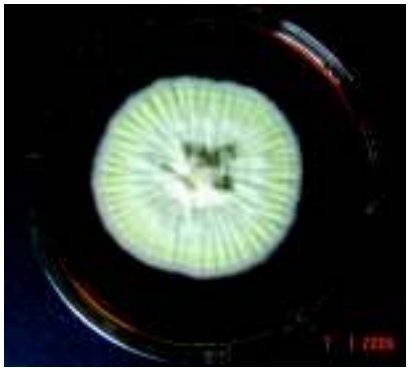
IN VITRO SCREENING FOR ANTIBACTERIAL ACTIVITY OF *ASPERGILLUS* SPECIES OF SARAWAK MANGROVE SOIL

A total number of 59 isolates of *Aspergillus* species were obtained from mangrove soil at Kampung Bako, Sarawak. Morphological and physiological studies were conducted on different strains of the *Aspergillus* species. They were confirmed as *A. terreus, A. flavipes, A. carneus, A. fumigatus* and *A. clavatus*. All five species were inoculated on Czapek's yeast extract agar and incubated at 25°C. Crude extracts obtained from the strains were evaluated for antibacterial activity against five common terrestrial bacteria: *Escherichia coli, Shigella sp, Staphylococcus aureus, Bacilus subtilis* and *Pseudomonas sp*. Crude extracts were applied to 6 mm sterile discs in aliquots of 30µl of solvent (Ethyl acetate), allowed to dry at room temperature, and placed on nutrient agar plates seeded with bacteria. The bacteria were maintained on nutrient agar plates and incubated at 37 °C for 24 hours to determine the inhibition effect of the fungus. In this study, only *A. flavipes* and *A. clavatus* showed strong antibacterial activity at a concentration of 30µg $disc^{-1}$ against all the tested bacteria.

Researcher:
Jaya Seelan Sathiya Seelan, Sepiah Muid

DIVERSITY OF *ASPERGILLUS* SPECIES IN SARAWAK MANGROVE FORESTS

A study on the diversity and distribution of *Aspergillus* spp. on selected mangrove forest in Sarawak was conducted. Samples were obtained from mangrove soils and leaf litters at different locations i.e. Sematan, Lundu, and Kampung Bako, Bako. Soil and leaf litter samples were taken randomly at different locations with five replicates from each area. A total of 138 isolates of *Aspergillus* species were obtained from the soil and leaf litters samples by using direct plating and Warcup method. Based on macroscopic and microscopic observations, guided by an identification key, individual isolates were classified within the genus *Aspergillus*, belonging to three subgenera, four section and five species. The fungi isolates were identified as A. terreus, *A. flavipes, A. carneus, A. fumigatus* and *A. clavatus*. The most common species isolated was *A. flavipes* (63.04%), followed by *A. fumigatus* (16.7%), *A. terreus* (13.04%), *A. carneus* (5.8%) and *A. clavatus* (1.44%). All of the isolated Aspergillus species grew well on MEA and CYA at 25°C. A. carneus produced reddish sclerotia on MEA after seven days and this could be used as an important characteristic in this species identification. *A. clavatus* from the mangrove soil in Kampung Bako shows long conidiophores (ranging from 3-5 cm) with swollen hyphal structures while *A. clavatus* from Sematan area has shorter conidiophores (ranging from 2.5-3.5 cm) on MEA.



A. flavipes

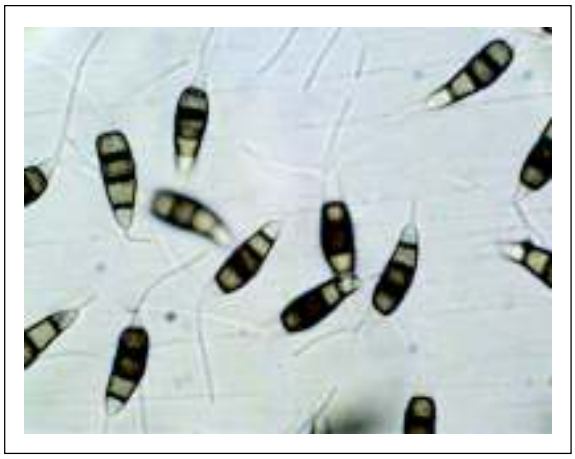
A. penicillioides

A. clavatus

Researcher:
Jaya Seelan Sathiya Seelan and Sepiah Muid

ENDOPHYTIC FUNGI OF PALMS

A study was conducted on endophytic fungi associated with ornamental palm (Licuala ramsayi), salak (*Salacca zalacca*), oil palm (*Elaeis guineensis*), pinang (*Areca catechu*), royal palm (*Roystonea regia*) and nipah (*Nypa*) collected in Kota Samarahan and Sungai Rayu. A diversity of endophytic fungi were found in the palms. The most common endophytic fungi isolated from the palm were the *Pestalotiopsis* species; others were *Chalara* sp., *Curvularia* sp., *Penicillium* sp., *Aspergillus* sp., *Trichoderma* sp., *Beltrania* sp., *Colletotrichum* sp. and *Nigrospora* sp.. The physiological characteristics of these fungi such as the effect of media, effect of temperature and effect of pH on growth were observed. Most of the fungi grew faster and had good formation on PDA and MEA compared to CMA. The rate of mycelia growth was significantly affected by temperature with optimum temperature ranging between 25°C to 30°C. However, for the effect of pH, no significant differences were observed on *Aspergillus* sp. and *Trichoderma* sp. in the test range of pH 3 and pH 9.



Spores of *Pestalotiopsis* sp.

Researcher:
Sepiah, M and Nurul Zaadah ,J.

SALTWATER CROCODILE (*CROCODYLUS POROSUS*) OF SARAWAK

Saltwater crocodiles, *Crocodylus porosus* (local name: Buaya Katak) are the most common crocodiles that inhabit the Sarawak coastal brackish waters and tidal sections of the rivers. But with the lack of genetic data on Sarawak crocodiles, issues related to genetic diversity, migration patterns, population and subpopulation structure have not been properly addressed. Therefore, this project is designed to obtain molecular data on Sarawak crocodiles using both DNA sequencing and protein allozyme assay. Sample collections (blood, muscles, scutes) and molecular analysis were conducted on individuals representing crocodiles from the northeastern part of Sarawak (Miri) and the western part of Sarawak (Kuching, Asajaya and Sibu). Based on putative 650bp Cytochrome b gene analyses, preliminary results from *C. porosus* showed a wide range of genetic divergence values (0 % to 41.7 %), indicating that some samples belong to the same species whereas others merit further research. Works to determine the C. porosus population structure, the sequence other genes and their allozyme profiles are still on-going. Hopefully, with the completion of this project, the genetic diversity of Sarawak crocodiles will be properly documented and the population structure determined to support the sustainable management of Sarawak crocodiles in future.

Sample collections for scutes (top), blood (middle) and tissues (bottom) were carried out on C. porosus individuals prior to molecular biology work.

Researcher:
Ruhana Hassan and Nur Sara Shahira Abdullah

MOLECULAR PHYLOGENY OF GREEN TURTLE *CHELONIA MYDAS* IN TALANG-SATANG NATIONAL PARK

Four species of marine turtles, namely leatherback turtle (*Dermochelys coriacea*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*) and olive ridley turtle (*Lepidochelys olivacea*) are found in Malaysia. In Sarawak, turtle conservation efforts include the establishment of Talang-Satang National Park in addition to the implementation of the Turtle Trust Ordinance of 1957, the Land Code 1958, the Turtle Protection Rules of 1962 and the Wildlife Protection Ordinance of 1998. Records for the recent years suggest landings of green turtles and hawksbill turtles in Satang Island at a ratio of 30:1. This study is designed to document the genetic diversity and molecular phylogeny within *C. mydas* populations in Talang-Satang National Park. A total of fifteen D-loop region sequences of approximately 400 bp and nine sequences of 16S rRNA gene of approximately 600 bp were obtained. Analyses showed that there were variations within species or subpopulations between the samples collected. Pairwise distance analysis revealed genetic divergence of zero to 6% and zero to 1.8% between individuals, using information on D-loop region and 16S rRNA gene, respectively. The phylogenetic tree constructed using both genes showed the presence of two clades: clade A comprises mixture of individuals from both islands and clade B which only showed individuals from Talang-Talang Island. Our findings indicate the extensive usage of sandy areas in both islands as nesting grounds for green turtles and suggest that the turtle's behaviour-wise theory of natal homing, chance-encounter and social facilitation is applicable to the green turtle rookeries. Further work will include a more extensive molecular data collection from turtles who are using other nesting grounds in Sarawak to further understand the migration paths of *C. mydas*, and thus, help support turtle conservation efforts in Sarawak.

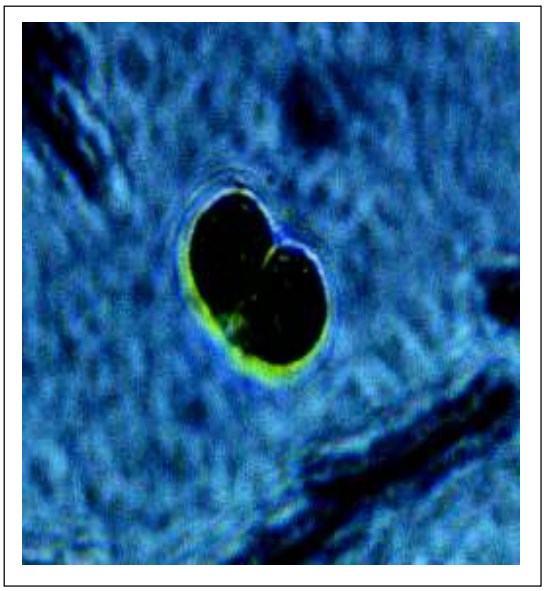
Hawksbill turtle (*Eretmochelys imbricata*) hatchlings [Pulau Satang, August 2008].

Green sea turtle (*Chelonia mydas*) hatchlings [Pualu Satang, August 2008].

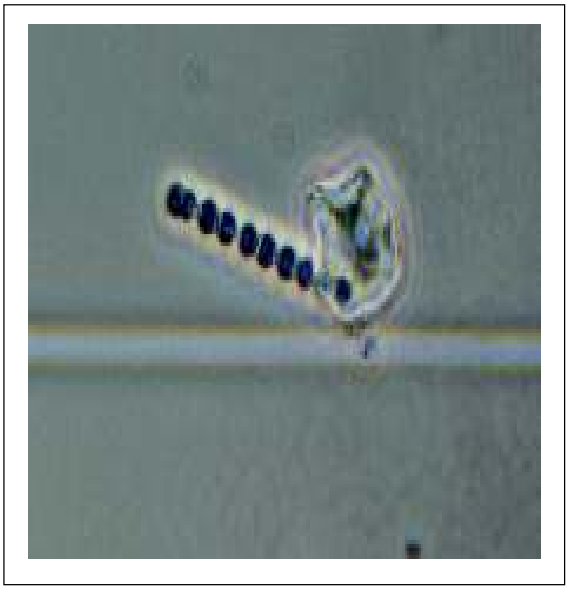
Researcher:
Ruhana Hassan and Nurhartini Kamalia Yahya

THE DIVERSITY OF CYANOBACTERIA FROM SELECTED AQUATIC ECOSYSTEMS IN SARAWAK

Cyanobacteria are microalgae that have the characteristics of both bacteria (prokaryotic cell organization) and algae (ability to photosynthesize like plants). They belong to the class Cyanophyceae. They have the ability to grow in most diverse ecological conditions and are very beneficial to mankind, although several produce toxins which may be toxic to human and animal. In addition, some cyanobacteria produce odorous metabolites that can cause "off-flavor" which have significant negative impact to the aquaculture sector. The aim of this study is to provide an update on the diversity of cyanobacteria in selected Sarawak aquatic ecosystem with focus on their composition and the evaluation of their diversity using beta indices. A number of eight stations which include aquaculture ponds, cage cultures, waterfall and artificial lake located in Serian, Bau and Batang Ai area were selected for this study. The Wilson & Shmida's (1984) formula was selected to analyze the beta diversity of the identified cyanobacteria. A total of 43 species belonging to 30 genera were recorded. *Oscillatoria* was the best represented genus, comprising 9% of the species composition in the samples. The most distributed pattern among all the sampling sites was of the genera *Chroococcus, Lyngbya, Noctoc* and *Oscillatoria.* The highest ß diversity value was found among non-contiguous sites. There were no identical or totally different cyanobacteria diversity values among those non-contiguous sites. The highest ß diversity values were found among sites with contrasting environmental characteristics. The wide range of ß diversity suggested that variations in the physico-chemical properties of the water may exist among the different locations and types of aquatic ecosystems which lead to the difference in cyanobacteria composition.

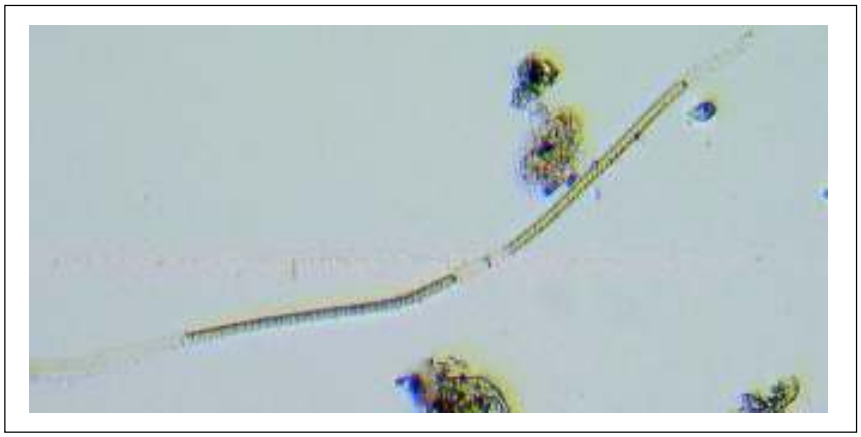


(a)



(b)

(c)



(d)

The most distributed genera among all sampling sites: (a) *Chroococcus*, (b) *Noctoc* (c) *Oscillatoria*, and (d) *Lyngbya*. Observations were made using Inverted Light Microscope Olympus M1025 – Microscope Research Fluorescence Model 1X51RFLCCD (Magnification: 400X)

Researcher:
Mohd Nasarudin Harith & Ruhana Hassan

BIRDS AND BATS OF LOAGAN BUNUT NATIONAL PARK AND CONSERVATION ISSUES

Loagan Bunut National Park (LBNP) covers an area of approximately 107 sq km of predominantly peat swamp forest. The park also consists of a seasonally inundated lake of about 6.5 sq km, which is fed by Sungai Teru during high water periods. The park is surrounded by oil palm plantations and logging camps which could potentially affect the hydrology of the lake and threaten the fragile ecosystem of the peat swamp forest. At risk are some of the peat swamp and lowland-dependent bird and bat species. Birds and bats were surveyed in the mixed dipterocarp (MDF) and peat swamp forests (PSF) of LBNP from August 2005 to June 2007. A total of 1,568 bird mist-net sampling sessions were conducted and 3,136 mist-net and harp-trap sessions were done for bats. Bird species were recorded from sampling points. The study recorded a total of 187 bird and 38 bats species in LBNP respectively, representing 30.2% and 41.3% of all Bornean species. One species of bird is listed as endangered in the IUCN Red List of Threatened Species, four are vulnerable and 46 others as near threatened species. For bats, one species is listed as vulnerable and another six as near threatened. The park has two bird and bat species which are endemic to Borneo. Land uses and development in and around the park are adversely affecting the bird and bat communities. As such, it is important to maintain the integrity of the park.

A harp trap used during survey

Green broadbill caught in mist net

Short-nosed fruit bat

Wildlife Conservation Society Malaysia

Researcher:
Jason Hon*, Melvin Gumal* and Alexander Sayok

MAMMALS AMONG DIFFERENT ECOSYSTEMS IN LOAGAN BUNUT NATIONAL PARK, SARAWAK

A study on non-flying mammals was carried out in different habitats using the transect line method with variable width for about 24 days during April and June 2007 at Loagan Bunut National Park Sarawak (LBNP). The study encountered 16 species from 8 families: 16 species from 126 individuals in mixed dipterocarp forest (MDF), 7 species from 58 individuals in logged-over/secondary forest (LO/SF), 5 species from 27 individuals in peat swamp forest (PSF) and 2 species from 23 individuals in riverine forest (RF). The squirrel's species and *Macaca nemestrina nemestrina* were the most common species in three habitats (MDF, LO/SF, PSF). The *Macaca fascicularis fascicularis* was recorded only in LO/SF and RF. The footprints of cervidae and suidae were fairly common in MDF, LO/SF and PSF. *Sus* sp. were only encountered once and *Cervus unicolor* twice. The *colobines, Presbytis chrysomelas,* was recorded three times in MDF but once in PSF. *Trachypithecus cristatus* was encountered once in RF. The existence of a group of red monkeys was reported by locals, but was never encountered by our team. Similar case for *Manis javanica*, Slow loris, bear cat and civet species. The claw marks o f *Helactros malayanus* was recorded twice in MDF. The night's survey conducted in MDF identified 5 species from 16 individuals. Except for *Hystrix brachyura*, all nocturnal mammals recorded were small. As expected, a greater abundance of frugivores were encountered in MDF as its canopy is multi-layered and more heterogeneous compared especially to LO/SF. Arboreal species were higher compared to terrestrial species. The latter was recorded higher in MDF and LO/SF compared to PSF and RF. In PSF, only two terrestrial species were recorded (*Cervus unicolor* and *Sus* sp.) but none in RF. No small mammals was recorded in both PSF and RF. No terrestrial species particularly small mammals occurred in PSF, probably due to (1) wet and muddy floor which made it difficult for them to move and (2) lack of food sources. The study suggested that an intensive phenological study needs to be carried out in LBNP to understand how food quality, distribution and abundance affect the mammals population. There is a possibility that the decreasing number of fish in the lake will make the locals change their habits from fishing to hunting and logging. The study also suggested that management authority put more effort to protect and conserve wildlife in the Park.

Researcher:
Ampeng A*, Sapuan Ahmad*, Sayok, A.K., Liam J*, Asen, M**

**Forest Department*,Sarawak,
***The Borneo Post Sdn Bhd*,

SACRED GROVES AND NEW FROG SPECIES

Sacred groves represent forests protected by local communities, some subsequently brought into formal protected areas systems. Protection of biodiversity therein appears incidental to protection of either individual trees or groves of sacred trees that may be adjacent to shrines, where harvesting of trees or removal of any living matter, is prohibited. Academic interest in sacred groves have centred around use of such sites for traditional activities, for protection of watersheds, forests and their biodiversity. A number of frog species have been described from sacred groves and forests worldwide, including China, India and Malaysia. We recently dis covered a new frog species, belonging to the genus *Leptolalax* from a sacred grove in Megha laya state, India, further emphasizes the unusual role human communities may inadvertently play in protecting amphibians, and of the generally poor knowledge of the regional amphibian diversity. The new species is diagnosable in showing the following combination of characters: SVL 24.5–27.3 (mean 25.63 ± 0.61 SE) mm in a sample of four adult males; 31.2–33.4 (mean 32.50 ± 0.67 SE) mm in a sample of three females; dorsum with fine scattered tubercles; eye lids with tubercles; tympanum and supratympanic fold distinct; macroglands, including preax illary, pectorals and ventrolateral glands present; Finger I > II; toe tips not dilated, bearing dermal fringes; dorsum with dark blotches; flanks with large dark blotches; dark tympanic mask present; venter lacking dark blotches; labial bars present and limbs with dark cross-bars.

(Note: paper in press, 2009. A new species of *Leptolalax* from Meghalaya State, north-eastern India (Anura: Megophryidae). Zootaxa, Auckland)

Male holotype of *Leptolalax* new species (ZSI A10955), in life.

Researcher:

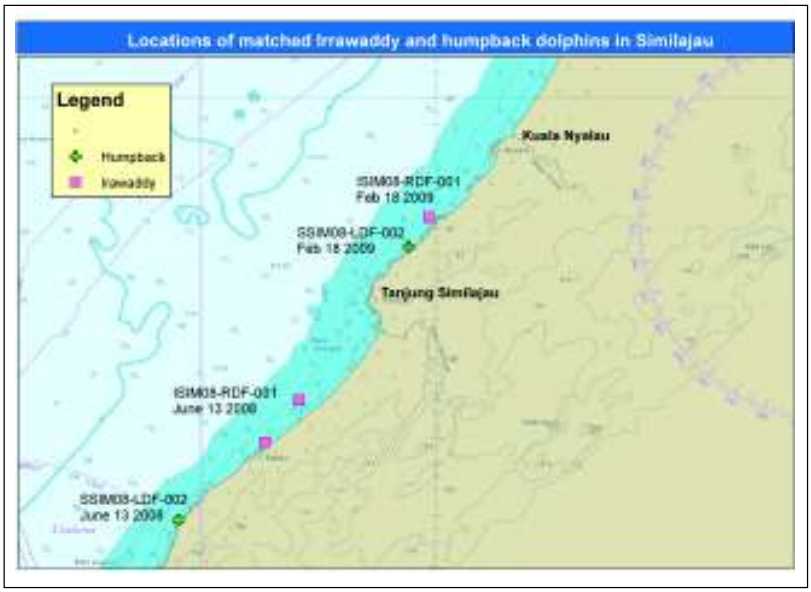
Indraneil Das, Ronald Tron*, Duwaki Rangad* & Rupa Hooroo*

*North Eastern Hill University, Shillong, India

COASTAL DOLPHINS IN SARAWAK

Dolphins worldwide are faced with a wide-ranging threat from intensive development and human use which includes habitat destruction, fisheries by-catch, prey-depletion due to over-fishing and dolphin tourism. In Sarawak, the dolphin's habitats are undergoing major changes in the forms of deep water port and flood mitigation channel construction. Therefore, the Sarawak Dolphin project (http://www.ibec.unimas.my/SDP2008) is aim at compiling baseline information on coastal dolphin distribution, ecology and conservation needs. Small boat surveys are focused on three main areas along Sarawak coastline: Kuching, Bintulu and Miri where line transect surveys will allow for the analysis of relative abundance and habitat preference, while the use of photo-identification will provide insight into the home ranges of some of the populations and their seasonal movements. The most observed dolphin species were the Irrawaddy dolphins, and finless porpoise. Bottlenose dolphins were less frequently observed and were captured only in the Kuching and Miri regions, whilst humpback dolphins were observed twice at Similajau. Initial inspection indicates that all four species seem to show a preference for shallow nearshore waters. 105 of 115 survey sightings occurred in less than 10 m water depth. In addition, photographic matches made in the Similajau survey area include one Irrawaddy dolphin and one humpback dolphin. In both cases, the re-sightings indicate that these particular dolphins have a home range which spans up and down the Similajau coastline between areas encompassed by the national park and one considered for large-scale industrial development. Re-sightings of individually identified Irrawaddy dolphins in Kuching showed clear movement between the two major bays in the study area. The re-sightings included individuals seen from one year to the next, as well as from one month to the next, confirming what is likely a year-round residence in the survey area.

Three main survey areas in Sarawak.



Researcher:
Cindy Peter, Gianna Minton and Andrew Alek Tuen.